MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

TCP 1211 – LOGIC PROGRAMMING

(All sections / Groups)

12 March 2016
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **6 pages** only including the cover page.
2. Attempt **ALL** questions.
3. All questions carry equal marks and the distribution of the marks for each question is given.
4. Please print all your answers **CLEARLY** in the Answer Booklet provided.

QUESTION (1)

(A) Translate the following statements into Prolog clauses: [5 marks]

- Tan likes anne.
- Adam likes anne.
- Anne likes adam.
- For all X and Y, X loves Y if X likes Y and Y likes X.
- For all X and Y, X is jealous of Y if X likes Z and Y likes Z, and nobody should be jealous of himself.

(B) Based on the Prolog clauses in (a), What answers do you expect for the following goals? [2 marks]

1. `?- loves(anne,Y),jealous(X,Y).`
2. `?- likes(X,anne),!; likes(anne,X).`

(C) Define the relationships: **`niece, cousin, aunt, stepson`** and **`son-in-law`** using the relations **`parent, spouse, male`** and **`female`** only. [8 marks]

QUESTION (2)

NOTE: Attempt any THREE out of FOUR Parts (A), (B), (C) and (D).

(A) Using **`conc`**, write a goal to perform each of the following tasks:

i) Delete the first three elements from the list [a,b,c,d,e,f] producing another list L1. [2 marks]

ii) Find the numbers that precede number 5 in the list [1,2,3,4,5,6,7,8] then delete the last element. the result should be

```
Before =[1,2,3,4],
New =[1,2,3] ;
```

[3 marks]

Hint: **`conc(L1,L2,L3)`** means concatenating the lists L1 and L2, producing the list L3.

(B)

i) Define the procedure for finding the smaller of two numbers **`min(X,Y,Min)`** *without using cuts* where Min = X if X is smaller than or equals Y, and Min = Y if X is greater than Y. [2 marks]

ii) Define the procedure in (i) in a more efficient way using cuts. [3 marks]

Continued ....

(C)

i) Considering the following Prolog program:

```
print([]).
print([X,Y|T]):- write(Y), print(T), write('N').
```

What would be the output of the following query? [2 marks]

```
?- print([1,2,3,[a,b],c,d,e,f]).
```

ii) Define the predicate **inter(L1,L2,L3)** that interleaves alternate elements of ***L1*** and ***L2*** into ***L3***. [3 marks]

For example:

```
?- inter([a,b,c],[1,2,3],D).
   D =[a,1,b,2,c,3].
```

(D)

i) Define the predicate **sumL(L,Sum)** so that **Sum** is the sum of a given list of numbers **L**. [2 marks]

For example:

```
?- sumL([10,20,30,5],A).
   A=65
```

ii) Define the procedure **splits(List,Greater,Smaller)** which splits a List of numbers into two lists: **Greater** which stores all the numbers greater than 5, and **Smaller** which stores all the numbers smaller than 5. [3 marks]

Continued ....

QUESTION (3)

(A) Given the following Prolog program, draw the SLD tree for the query **?- p(X).** [5 marks]

```
m(c).                    %1
r(b).                    %2
s(a).                    %3
s(b).                    %4
u(c).                    %5
p(X):-u(X).              %6
p(X):-q(X),r(X).         %7
p(X):-m(X),n(X).         %8
q(X):-s(X).              %9
```

(B) What answer do you expect for each of the following goals? [5 marks]

```
1) ?- X == peter.
2) ?- X = Y.
3) ?- X=:=Y.
4) ?- X = 3, Y = X+2-2, X=:=Y.
5) ?- X = 3, Y is X+2-2, X=:=Y.
```

(C)

i) Rewrite the following formulas in *prefix* and *postfix* formats (order).
`8-1+9*3` [3 marks]

ii) What is the difference between the unification predicates "=" and "is"? [2 marks]

Continued ....

QUESTION (4)

NOTE: Attempt any THREE out of FOUR Parts (A), (B), (C) and (D).

(A) Assume that a Prolog program contains the following facts:

```
man (father (X)).
man (john).
man (brother (john) ).
generous (wife (john)).
likes (father (X), X) :- generous (X).
```

Write all Prolog's answers to the following queries: [5 marks]

```
1) ?- man (X), likes (X, wife(Y)).
2) ?- likes (father (X) , X).
3) ?- likes (X, Y).
```

(B)

i) The state-transition concept is the basic idea behind the problem-solving techniques using search. In order to solve a problem using search, two main tasks are required. What are these tasks? [2 marks]

ii) Briefly define two basic search strategies. [3 marks]

(C)

A *unifier* of two simple expressions E, F is a substitution θ such that $E\theta = F\theta$. If two simple expressions have a unifier, they are said to be *unifiable*; we also say that E is unified with F by the unifier θ.

i) Define formally the most general unifier of E and F. [2 marks]

ii) Determine the *unifier* θ for each of the following cases. [3 marks]

```
1) E = study(adam,math).
   F = study(adam,english).

2) E = likes(X,wife(john)).
   F = likes(brother(Z),Z).

3) E = meet(anne,john).
   F = meet(X,john).
```

Continued ....

(D)

i) What is negation as failure? [3 marks]

ii) Discuss the common misuse of negation as failure. [2 marks]

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